REMARKS/ARGUMENTS

Claims 1-26 remain in the application.

A. Rejections under 35 U.S.C. 102.

Claims 1-10, 12-13, 15, and 20-26 were rejected under 35 U.S.C. 102 based upon Nelson. This rejection is respectfully traversed.

Independent claims 1, 15 and 20 are amended to use the word "mixing" rather than "combining" to more specifically distinguish the claims from either AB switching or multiplexing/demultiplexing taught in the relied on references.

Although this term is used in the specification and claims according to its common meaning in the media industries, the IEEE Dictionary of Standard Terms provides some useful definitions:

Mixer: In a sound transmission, recording or reproducing system, a device having two or more inputs, usually adjustable, and a common output, which operates to combine linearly in a desired proportion the separate input signals to produce an output signal.

Video mixing: The formation of a graphical display image by the merging of two images, one from a display buffer and one from a video signal.

Multiplexing: (1) The combining of two or more signals into a single wave from which the signals can be individually recovered. (2) The division of a transmission facility into two or more channels...by allotting this common channel to several different information channels one at a time (time-division multiplexing).

An article entitled "MIXING VIDEO SOURCES: DIGITAL VIDEO" also accompanies this response. This article is submitted as background material as an example of how the terms mixing and switching are used in the context of video technology.

The relied on references do not show or suggest a controller that is configured for mixing the first and second time-adjusted streams into a composite media stream. While the terms "mixing" and "composite" are used in a variety of other contexts to have more general meaning, as used in the context of video, audio, and multimedia delivery the terms have a specific meaning that is distinct from what is being done in the Nelson reference. Nelson's system would not function if the separate channels of information were allowed to mix as it is fundamental to Nelson that each channel of information be extractable from the transport. Accordingly, claims 1 and 2-10 and 12-14 depend from claim 1 are believed to be allowable over Nelson.

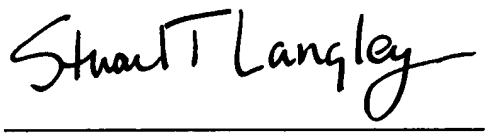
Claim 20 is amended to call for creating a synchronized media stream by mixing the first and the second media streams. Nelson does not show or suggest mixing streams and, as set out above, would not function for its intended purpose if the distinct channels of information were allowed to mix. Claims 20-26 are believed to be allowable for at least the same reasons as claims 1, and the claims that depend from claim 1, that are set out above.

B. Conclusion.

In view of all of the above, the claims are now believed to be allowable and the case in condition for allowance which action is respectfully requested. Should the Examiner be of the opinion that a telephone conference would expedite the prosecution of this case, the Examiner is requested to contact Applicants' attorney at the telephone number listed below.

This response is filed together with a Request for Continued Examination ($395.00) and a petition for an extension of time (3 mos.) ($510 less $60 previously paid with the response filed on July 11, 2005). Any fee deficiency associated with this submittal may be charged to Deposit Account No. 50-1123.

Respectfully submitted,



September 12, 2005

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Attachment

Mixing Video Sources: Digital Video

All About Video Mixers, Time Base Correction, Frame Synchronization, and Other Digital Video Concepts

"Fields, frames, time base correction, A/B roll, frame synchronization...!" Adding a second video source sure seems to complicate video editing! This primer explains the concepts involved in combining two or more video sources using a video mixer such as the Videonics MX-1 Digital Video Mixer.

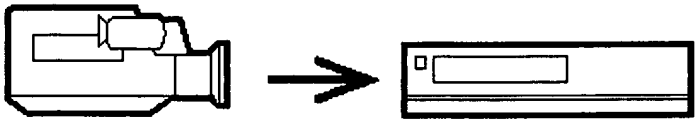
Don't worry if the details sound technical. The **Bottom Line** *sections explain what you really need to know.*

Contents

For more information

- Using a Video Mixer explains how mixers are used in real-world video production applications.
- About 10-bit 4:2:2 Digital Video describes details of digitized video and how digitization specifications and methods affect what you see on the screen.

Single-Source Editing: Cuts-Only

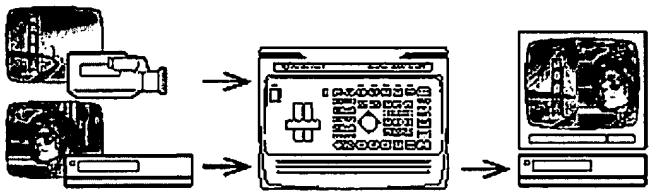


The most basic form of editing uses a single video source -- generally a camcorder. Scenes are selectively copied, one at a time, from the camcorder tape to the blank final production tape in the VCR.

In single-source editing, one video scene ends before a second one begins. Most commonly, a cut is used: Scene 1 ends abruptly (Cut!) -- then Scene 2 begins. This is called *cuts-only* editing. It can be accomplished with just a camcorder and VCR but an edit controller, such as Videonics Thumbs Up or Edit Suite, can be used to control the player and recorder. Controllers make editing far more precise and convenient and they make it easy to repeat the editing sequence, to make another edited tape, or to make changes.

(For more information: See Video Editing with Consumer and Industrial Equipment.)

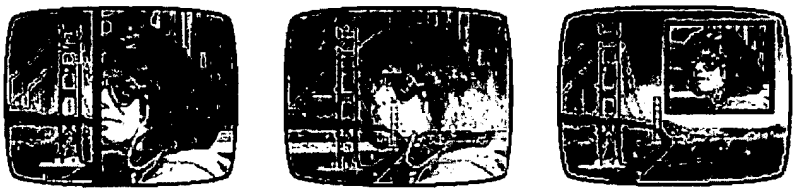
Two-Source Editing: "A/B roll"



Higher end editing systems, including most professional television production studios, use two or more original videotapes. Scene 1 may come from one machine (A) while scene 2 comes from a second player (B). During a transition, both machines (A and B) are rolling (playing), hence the name A/B roll editing.

As with cuts-only editing, an edit controller can be used to automate the process or the machines can be controlled manually. However, manual A/B roll editing is a tremendous challenge because the two machines must be rolled together in such a way that the right scenes are playing at the right moment. In real-world A/B roll editing, edit controllers are almost always used to accomplish this tricky task.

An A/B roll system is usually equipped with a device called a *video mixer*. The mixer allows video images to be combined and creates sophisticated transitions between scenes.



Wipe *Dissolve* *Zoom*

Examples: Scene 1 (coming from source A), is San Francisco's Golden Gate Bridge. Scene 2 (from source B) is a woman's face. We can cause the bridge to fade away as the woman fades in. This is called a dissolve. Or we could use a wipe, in which a line moves across the screen, pushing Scene 1 aside as Scene 2 comes in. Or Scene 2 can zoom in from the corner.

These effects, along with others that will be described later, have something in common: **In the middle of the transition, both videos are on screen at the same time.** This requires that the two sources by *synchronized* -- that each video frame of source A starts at the same instant as each frame from source B. A video mixer is the most common way to synchronize two sources.

Note: Using a Video Mixer describes real-world mixing applications.

Genlock (Part One)

Some basic transitions can be performed without a video mixer by electronically-generating a source to match the timing of the moving video source. Such a signal is called genlocked because it is *gen*erated in a way that *lock*s its timing to the video source.

Genlocked video title, superimposed on video

Genlocked images are usually solid color backgrounds, titles, or computer-generated graphics. Since the genlocked image is created in step with the moving video source, it is possible to perform fades, wipes, and other transitions between them. These transitions can be performed in either direction -- from video source to genlocked image, or vice-versa.

The term "genlock" is also used to refer to synchronizing a video signal to a house reference, discussed later.

"Poor-Man's" Dissolve

A genlocked system can fade from one scene to a solid color then fade from the color to the next scene. This looks a lot like a dissolve but the solid color screen in between means that the two video scenes never appear on the screen at the same time. A fade of this kind is sometimes called a "poor-man's dissolve" to reflect the fact that it can be done with relatively inexpensive equipment.

A somewhat more elaborate system can genlock a graphic or titles, in addition to solid color backgrounds. The concept is the same and the effect looks like a dissolve between moving video and the graphic and titles.

The same idea applies to wipes: A wipe can be between two moving sources (requiring a mixer) or it can transition from moving video to a genlocked background, title, or graphic (using simpler equipment).

Similarly, a superimpose effect can be accomplished with a genlocked system, placing elements such as titles atop moving video.

The Videonics Video TitleMaker is an example of a system that can create genlocked images and titles, and superimpose them on moving video, with fades and wipes in between. It creates titles, solid color and patterned backgrounds, and even scrolling titles that are genlocked to the original video, and it fades and wipes between the moving video and the titles and backgrounds.

The important distinction is that while simple equipment can fade to a genlocked solid color, title, or graphic, a mixer with a mixer is needed for a dissolve or wipe between two independent video sources, such as two VCRs.

BOTTOM LINE:
What you really need to know

Simple video editing systems perform cuts-only editing. The desired video footage is copied from the original tape to a new tape. Fades and wipes to backgrounds, titles, and graphics are possible, but a system with a video mixer is required for any transition in which two scenes are on the screen at once.

A/B roll systems can edit scenes from two separate videotapes. They generally include a video mixer which performs transitions, such as dissolves and wipes, to gradually change from one scene to the next, without having to use solid color screens in between.

Frames and Fields

A video picture is made up of many still pictures, rapidly flashing by. Each still picture is called a frame. Each of these frames is made up of hundreds of horizontal lines. You can see the lines if you look very closely at the video screen.

Each frame appears in two halves. The first half of the picture contains every other line of video (lines number 1, 3, 5, 7, etc.). The second half contains the rest of the lines (lines 2, 4, 6, etc.). Each half-frame is called a field.

In the NTSC system used in North America and Japan, there are 30 frames per second (60 fields per second); in the European PAL system, there are 25 frames (50 fields) per second.

Frame Synchronization

Two independent video sources are likely to start at different times. For example, picture A may be displaying the start of line 122 of a frame at the moment B is starting line 1. It is not possible to have two unsynchronized sources on the screen at the same time, so dual-source editing setups usually include a *frame synchronizer.*

A frame synchronizer is a fairly sophisticated device that electronically delays one of the two video sources until the second one begins a new field. To do this, it must be able to electronically store one field's worth of video so that, regardless of the timing difference between the two sources, one can be held until the second one comes along.

The bad news is that it takes a lot of storage to hold a field of video (700 kilobytes for a full broadcast quality frame, without data compression). The good news is that memory prices have finally reached the point where a video mixer with a frame synchronizer can be purchased for a reasonable price, making A/B roll editing available to more video producers.

Switching

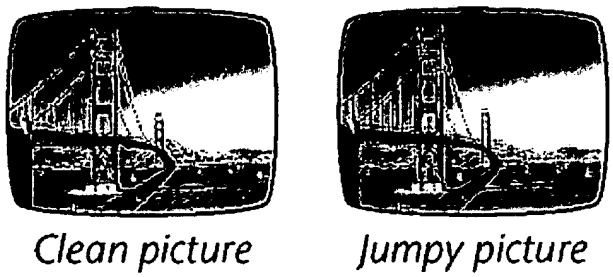
In professionally produced television shows, cuts are used far more often than wipes, dissolves, or fancy effects. But even a simple cut benefits from a mixer's synchronizing capability.

If you use a simple switch to cut from one video source to another, there may be a vertical roll or other disruption in the picture, depending on how closely synchronized the sources happen to be. If the two sources happen to be starting at about the same instant, there will be little disruption; if they are far out of step, the roll could be pronounced.

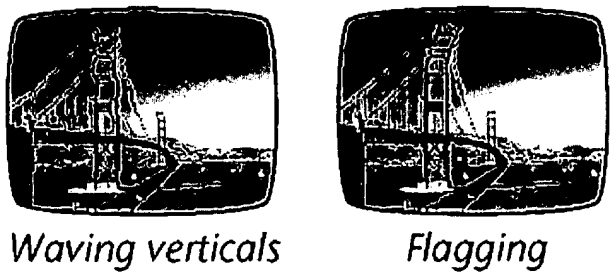
A good video switcher will include a frame synchronizer, to insure that both sources are in perfect harmony and provide smooth, clean cuts.

Timing is Everything

A video signal's time base determines when each line, each field, and each frame begins. A clear, steady picture requires an accurate, unchanging time base. If lines start early or late, the picture will shift or waver in various ways.



Clean picture *Jumpy picture*



Waving verticals *Flagging*

Time base problems can cause the entire picture to jump or waver. Or they can cause part of the picture to move. Flagging is one common problem. In a flagging picture, just the top portion of the picture will lean to the right, possibly waving back and forth, like a flag in the wind. The flagged portion may also show a color shift.

You can see time base error in most images played by consumer VCRs. Watch a tape and look for a sharp vertical line that does not move across the frame. You may need to record some footage of your own to find such a line. Notice how the line wiggles as the tape plays? Notice how the line is slightly fractured, with segments shifted slightly to the left and right? These wiggles are time base errors.

Even excellent recordings, played by expensive VCRs, exhibit time base error. At their best, the effects are fairly slight and few people notice them. But in editing, each scene is copied at least once, amplifying the error and increasing the degradation. And critical viewers will always be able to notice them, especially when conditions are less than optimal. Noisy recordings further increase time base errors as they make it harder to identify the exact instant a line begins.

A device called a time base corrector, or TBC, can be used to reduce time base error. Connected to the output of a VCR, a TBC can remove most or all of the flagging, shaky pictures, wavy lines, and other time base problems. Because some time base error is inevitable anytime videotape is involved, professional studios almost always use a TBC whenever they copy a tape.

The term TBC is sometimes erroneously applied to equipment that only has a frame synchronizer. The MX-1 Digital Video Mixer has a true TBC.

Genlock (Part Two)

When multiple pieces of video equipment are used together, there is a great advantage to having them all locked together so that every video frame from every source starts at the same instant. This is done using TBCs equipped with a reference, or sync, input. A standard reference video signal, often called house black or black burst, is routed to each reference input. The TBC times its output so it is synchronized with whatever is connected to the reference input. This process is often called genlock since the TBC output is generated such that it is locked to the reference.

BOTTOM LINE:
What you really need to know

A video mixer includes a frame synchronizer. This device delays one video source so that it starts at the same moment as a second source. Because frame synchronizers must electronically store video, they are quite sophisticated, but essential for transitions between two moving video sources. Even simple cuts benefit from synchronization.

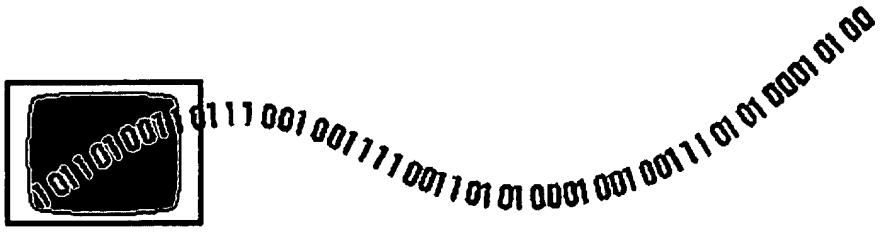
Even more sophisticated, and far superior, is a frame synchronizer with time base corrector, or TBC, which not only synchronizes two pictures, but also cleans up their timing. This is important since VCRs, especially consumer models, are subject to some time base error, which causes wobbly lines and other picture flaws. A TBC can correct such errors, delivering a stable picture even when both sources have a time base error. The Videonics Digital Video Mixer includes an automatic TBC.

Line, Field, and Frame Store

Inside every mixer is enough digital memory to hold part of the video picture. The simplest devices, capable of small amounts of time base correction, hold only a line or two (a line store). Frame synchronizers must store a full field (field store). The best TBCs, capable of correcting two sources, store at least two fields (dual-field store). The Videonics MX-1 Digital Video Mixer has a dual-field TBC.

Digital Video

The most advanced video devices today use digital video circuitry to deliver advanced features and performance at affordable prices. In this equipment, the video signal is digitized (converted to digital form). It literally becomes a high-speed stream of numbers that represent the original signal, the way numbers are represented inside a computer. Computer-type circuits then operate on the signal to produce the desired effects and perform functions, such as synchronization and TBC. The signal is converted back into normal (analog) form before it is sent to the output jacks.



This digital magic happens automatically. The user doesn't need to understand how it works to receive the benefits. Most effects and features can be done better and more economically using digital video technology. Many simply cannot be done without it. Digital circuits have another important advantage -- they are more reliable and work for years with little or no adjustment.

Video Quality: Ready for Prime Time?

The quality of a digital video signal is determined by how it is digitized and how carefully the time base is maintained. It is often a function of price because the amount of memory (video RAM) needed to store a full quality picture is considerably higher than that required for a reduced quality picture.

Note: The following section refers to *NTSC* and *PAL*. NTSC is the television definition standard used in North America, Japan, and other regions. PAL is the standard used elsewhere, especially in Europe.

In very technical terms, the most common broadcast specifications require video be digitized with 8-bit samples of the video at 13.5 MHz, with a 4:2:2 sampling ratio. This means that 13.5 million times per second, an 8-bit (256-level) reading of the black and white component (the luminance, or Y, component) is taken. For every 4 samples of the black and white component, 2 samples of each of the two color components (U and V) are taken. 16-bits are captured for each on-screen picture dot (pixel).

Many consumer-level digital products work at lower sampling rates, with fewer bits per pixel, and a 4:1:1 ratio, reducing the amount of information captured. The NTSC * version of the MX-1 delivers a broadcast quality picture with 14.318 MHz, 8-bit, 4:2:2 sampling. The PAL * version of the product uses 17.72 MHz sampling.

Broadcast-level products go beyond these specs, delivering 10-bit 4:2:2 or 4:4:4.

Horizontal resolution is an important specification. It describes the amount of detail in the picture. Unfortunately, it is often given in *lines,* a non-standardized measurement whose meaning varies. Broadcast quality digitization specs are a better indicator of high resolution. Bandwidth is another way to measure resolution. NTSC broadcast bandwidth is 4.2 MHz. PAL is 5.0 MHz.

A product's *signal to noise* ratio, or *S/N* ratio, indicates how clean the signal will be. S/N ratios of over 50 dB can be achieved in the better digital units.

Another important area is time base accuracy. The MX-1 meets EIA specification RS-170A, an NTSC broadcast timing spec. (The PAL version of the product meets PAL standards.)

Note that passing a non-broadcast signal through a mixer with broadcast specs does not necessarily create a broadcast-ready signal. The MX-1, with its TBC, can correct a non-RS-170A signal to make it meet RS-170A specs, but most mixers cannot, since they lack a TBC.

The MX-1 also meets the FCC's NTSC broadcast specifications (the PAL version meets PAL standards). These rules spell out time base requirements similar to RS-170A and go on to define voltage levels, color signals, etc. To put it another way, the output of the unit could be connected directly to a television broadcast transmitter and the result would be legal to broadcast!

Note: About 10-bit 4:2:2 Digital Video describes additional digitization specifications.

Digital Effects and Transitions

Once a video picture is digitized, most mixers can add digital video effects (pros use the term DVE for effects that use digital circuitry). Some effects require that the picture be stored in digital memory; others can be accomplished with less storage.

Fade

Picture A fades away as a solid color (such as black) fades in.

Dissolve
: Picture A fades away as picture B fades in. In between, both are superimposed on the full screen.

Wipe
: A straight line or other shape is used to transition. Picture A is wiped away by the boundary and picture B is left in its wake. A variety of lines and shapes can be used: Horizontal, vertical, diagonal, shapes such as diamonds and circles, etc.

Border
: A wipe boundary can be a fixed-width color line. Or it can be an out of focus (soft-edge) line.

Slide
: Picture A slides off the screen as picture B slides on. The difference between a slide and a wipe is that with a wipe, the picture itself does not move -- instead the wipe edge sweeps across, revealing the picture as it goes. With a slide, the entire picture slides across the screen.

Squish, stretch
: Picture A is squished, becoming smaller and smaller. Meanwhile, picture B starts from a zero-width line at one side and is stretched across the screen until it becomes normal size, filling the screen.

Wipe combinations
: Wipes, slides, squishes and borders can be mixed and matched. For example, imagine picture A sliding to the right while picture B is stretched into place.

Compress or Zoom
: Picture is enlarged or reduced.

Flip
: The picture is mirror imaged either horizontally or vertically.

Tumble
: Picture A shrinks horizontally, then expands, forming the effect of tumbling away, like a card flipping off into the distance. B is left behind.

Fly-in
: Picture B appears very small, in the corner. It moves in toward the center and grows at the same time, following a trajectory, until it fills the screen.

Picture-In-Picture (Also called PIP).
: Picture B appears in reduced size, sharing the screen with A, which fills the rest of the frame. Picture B can be varied in size or positioned in the frame.

Mosaic
: The picture is divided up into a square pattern, with each square a solid color, reducing the picture to an abstract. The size (and number) of squares can be varied.

Freeze
: The picture freezes into a still image.

Strobe
: Still frames are periodically taken from the video picture and held on -screen until the next still is taken. The result is a start-stop, strobo scopic effect. The strobe rate can be varied.

Paint (Also called Art or Posterization).
: The picture is reduced to a small number of colors, giving an oil-paint look. The number of colors can be varied.

Solarization
: Strictly speaking, this is an effect in which the lightest and darkest values are made dark while middle tones become light. Modeled after a classic art photography technique, it is not the same as posterization, but the two terms are often interchanged.

Black and white
: The picture is converted to black and white.

Negative
: Levels are inverted to make the result look like a negative image. The black and white and color portions can be separately inverted for a different look. Black and white negative turns black to white and vice -versa; color negative turns red to blue-green, yellow to blue, etc.

Filter
: The picture is tinted in any color.

Compose
: The user composes a video picture that can consist of lines, rect angles, borders, etc. as well as still or moving video frames.

Keying
: See next section.

Keying

Advanced units can "key" one picture over another. The most familiar use is in television newscasts, to show a weather map behind the weather forecaster.

A solid color panel (usually bright green or blue) is placed behind the announcer and one camera is aimed at the announcer. A second video source carries the weather map.

The mixer is set up to detect the color of the panel behind the announcer. Wherever that color appears in the picture, the mixer electronically substitutes the second video source (the weather map). As long as the color does not also appear on the announcer's body or clothing, the effect is convincing and the weather map looks as if it's on the wall behind the announcer.

Anything in a picture, not just the background, can be used for keying effects. For example, imagine a woman holding a book with a blue cover. If a second image is keyed over the blue, it would look like the woman is holding a book with a moving video image on its cover!

This effect is called chroma key.

Chroma key can be used to replace the solid color background of one picture (in this case, the fish) with a second picture (the bridge).

Luminance keying replaces parts of one video image with another, based on the lightness or darkness of the original. It is a variable effect in which parts of the image are fully replaced, other parts are not, and tones in between are mixed.

Example: If A is a cloudy sky, and B is a field of grass, the darkest portions of the sky might come from A and be unchanged; the lightest portions would be all B; and areas that are between light and dark would be a mix, with more B in lighter areas and more A in darker areas.

Luminance key is most often used as a wild and crazy effect to deliberately make parts of the second image replace many parts of the primary image. Chroma key is used more often to replace an object or a background.

BOTTOM LINE:
What you really need to know

Digital video can deliver superior features, quality, and reliability. Many dramatic effects are possible once the video is in digital form, including keying, a high-end effect that lets you replace part of one video with a second video source.

There is a tradeoff between cost and video quality. The best digital video mixers, such as the Digital Video Mixer, meet broadcast resolution, signal to noise, FCC, and time base specs.

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